



SEQUENCE LISTING

<10> Yu , Su-May  
Shaw, Jei-Fu

<120> TRANSGENIC SEEDS EXPRESSING  
AMYLOPULLULANASE AND USES THEREOF

<130> 08919-067001

<140> 10/050,763

<141> 2002-01-16

<160> 13

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 1481

<212> PRT

<213> Thermoana ethanolicus

<400> 1

Met	Phe	Lys	Arg	Arg	Thr	Leu	Gly	Phe	Leu	Leu	Ser	Phe	Leu	Leu	Ile
1				5					10					15	
Tyr	Thr	Ala	Val	Phe	Gly	Ser	Met	Pro	Val	Gln	Phe	Ala	Lys	Ala	Glu
			20					25					30		
Thr	Asp	Thr	Ala	Pro	Ala	Ile	Ala	Asn	Val	Val	Gly	Asp	Phe	Gln	Ser
		35					40					45			
Lys	Ile	Gly	Asp	Ser	Asp	Trp	Asn	Ile	Asn	Ser	Asp	Lys	Thr	Val	Met
	50					55					60				
Thr	Tyr	Lys	Gly	Asn	Gly	Phe	Tyr	Glu	Phe	Thr	Thr	Pro	Val	Ala	Leu
65					70					75					80
Pro	Ala	Gly	Asp	Tyr	Glu	Tyr	Lys	Val	Ala	Leu	Asn	His	Ser	Trp	Glu
				85					90					95	
Gly	Gly	Gly	Val	Pro	Ser	Gln	Gly	Asn	Leu	Ser	Leu	His	Leu	Asp	Ser
			100					105					110		
Asp	Ser	Val	Val	Thr	Phe	Tyr	Tyr	Asn	Tyr	Asn	Thr	Ser	Ser	Val	Thr
		115					120					125			
Asp	Ser	Thr	Lys	Tyr	Thr	Pro	Ile	Pro	Glu	Glu	Lys	Leu	Pro	Arg	Ile
		130				135						140			
Val	Gly	Thr	Ile	Gln	Ser	Ala	Ile	Gly	Ala	Gly	Asp	Asp	Trp	Lys	Pro
145					150					155					160
Glu	Thr	Ser	Thr	Ala	Ile	Met	Arg	Asp	Tyr	Lys	Phe	Asn	Asn	Val	Tyr
				165					170					175	
Glu	Tyr	Thr	Ala	Asn	Val	Pro	Lys	Arg	Tyr	Tyr	Glu	Phe	Lys	Val	Thr
			180					185						190	
Leu	Gly	Pro	Ser	Trp	Asp	Ile	Asn	Tyr	Gly	Leu	Asn	Gly	Glu	Gln	Asn
		195					200					205			
Gly	Pro	Asn	Ile	Pro	Leu	Asn	Val	Ala	Tyr	Asp	Thr	Lys	Ile	Thr	Phe
	210					215					220				
Tyr	Tyr	Asp	Ser	Val	Ser	His	Asn	Ile	Trp	Thr	Asp	Tyr	Asn	Pro	Pro
225					230					235					240
Leu	Thr	Gly	Pro	Asp	Asn	Asn	Ile	Tyr	Tyr	Asp	Asp	Leu	Lys	His	Asp
				245					250						255

Thr His Asp Pro Phe Phe Arg Phe Ala Phe Gly Ala Ile Lys Thr Gly  
 260 265 270  
 Asp Thr Val Thr Leu Arg Ile Gln Ala Lys Asn His Asp Leu Glu Ser  
 275 280 285  
 Ala Lys Ile Ser Tyr Trp Asp Asp Ile Lys Lys Thr Arg Thr Glu Val  
 290 295 300  
 Pro Met Tyr Lys Ile Gly Gln Ser Pro Asp Gly Gln Tyr Glu Tyr Trp  
 305 310 315 320  
 Glu Val Lys Leu Ser Phe Asp Tyr Pro Thr Arg Ile Trp Tyr Tyr Phe  
 325 330 335  
 Ile Leu Lys Asp Gly Thr Lys Thr Ala Tyr Tyr Gly Asp Asn Asp Glu  
 340 345 350  
 Gln Leu Gly Gly Val Gly Lys Ala Thr Asp Thr Val Asn Lys Asp Phe  
 355 360 365  
 Glu Leu Thr Val Tyr Asp Lys Asn Leu Asp Thr Pro Asp Trp Met Lys  
 370 375 380  
 Gly Ala Val Met Tyr Gln Ile Phe Pro Asp Arg Phe Tyr Asn Gly Asp  
 385 390 395 400  
 Pro Leu Asn Asp Arg Leu Lys Glu Tyr Ser Arg Gly Phe Asp Pro Val  
 405 410 415  
 Glu Tyr His Asp Asp Trp Tyr Asp Leu Pro Asp Asn Pro Asn Asp Lys  
 420 425 430  
 Asp Lys Pro Gly Tyr Thr Gly Asp Gly Ile Trp Asn Asn Asp Phe Phe  
 435 440 445  
 Gly Gly Asp Leu Gln Gly Ile Asn Asp Lys Leu Asp Tyr Leu Lys Asn  
 450 455 460  
 Leu Gly Ile Ser Val Ile Tyr Leu Asn Pro Ile Phe Gln Ser Pro Ser  
 465 470 475 480  
 Asn His Arg Tyr Asp Thr Thr Asp Tyr Thr Lys Ile Asp Glu Leu Leu  
 485 490 495  
 Gly Asp Leu Asp Thr Phe Lys Thr Leu Met Lys Glu Ala His Ala Arg  
 500 505 510  
 Gly Ile Lys Val Ile Leu Asp Gly Val Phe Asn His Thr Ser Asp Asp  
 515 520 525  
 Ser Ile Tyr Phe Asp Arg Tyr Gly Lys Tyr Leu Asp Asn Glu Leu Gly  
 530 535 540  
 Ala Tyr Gln Ala Trp Lys Gln Gly Asp Gln Ser Lys Ser Pro Tyr Gly  
 545 550 555 560  
 Asp Trp Tyr Glu Ile Lys Pro Asp Gly Thr Tyr Glu Gly Trp Trp Gly  
 565 570 575  
 Phe Asp Ser Leu Pro Val Ile Arg Gln Ile Asn Gly Ser Glu Tyr Asn  
 580 585 590  
 Val Lys Ser Trp Ala Asp Phe Ile Ile Asn Asn Pro Asn Ala Ile Ser  
 595 600 605  
 Lys Tyr Trp Leu Asn Pro Asp Gly Asp Lys Asp Ala Gly Ala Asp Gly  
 610 615 620  
 Trp Arg Leu Asp Val Ala Asn Glu Ile Ala His Asp Phe Trp Val His  
 625 630 635 640  
 Phe Arg Ala Ala Ile Asn Thr Val Lys Pro Asn Ala Pro Met Ile Ala  
 645 650 655  
 Glu Leu Trp Gly Asp Ala Ser Leu Asp Leu Leu Gly Asp Ser Phe Asn  
 660 665 670  
 Ser Val Met Asn Tyr Leu Phe Arg Asn Ala Val Ile Asp Phe Ile Leu  
 675 680 685  
 Asp Lys Gln Phe Asp Asp Gly Asn Val Val His Asn Pro Ile Asp Ala  
 690 695 700  
 Ala Lys Leu Asp Gln Arg Leu Met Ser Ile Tyr Glu Arg Tyr Pro Leu

705		710		715		720
Pro Val Phe Tyr Ser Thr Met Asn Leu Leu Gly Ser His Asp Thr Met						
	725			730		735
Arg Ile Leu Thr Val Phe Gly Tyr Asn Ser Ala Asn Glu Asn Gln Asn						
	740			745		750
Ser Gln Glu Ala Lys Asp Leu Ala Val Lys Arg Leu Lys Leu Ala Ala						
	755			760		765
Ile Leu Gln Met Gly Tyr Pro Gly Met Pro Ser Ile Tyr Tyr Gly Asp						
	770			775		780
Glu Ala Gly Gln Ser Gly Gly Lys Asp Pro Asp Asn Arg Arg Thr Phe						
	785			790		800
Ser Trp Gly Arg Glu Asp Lys Asp Leu Gln Asp Phe Phe Lys Lys Val						
	805			810		815
Val Asn Ile Arg Asn Glu Asn Gln Val Leu Lys Thr Gly Asp Leu Glu						
	820			825		830
Thr Leu Tyr Ala Asn Gly Asp Val Tyr Ala Phe Gly Arg Arg Ile Ile						
	835			840		845
Asn Gly Lys Asp Val Phe Gly Asn Ser Tyr Pro Asp Ser Val Ala Ile						
	850			855		860
Val Val Ile Asn Lys Gly Glu Ala Lys Ser Val Gln Ile Asp Thr Thr						
	865			870		875
Lys Phe Val Arg Asp Gly Val Ala Phe Thr Asp Ala Leu Ser Gly Lys						
	885			890		895
Thr Tyr Thr Val Arg Asp Gly Gln Ile Val Val Glu Val Val Ala Leu						
	900			905		910
Asp Gly Ala Ile Leu Ile Ser Asp Pro Gly Gln Asn Leu Thr Ala Pro						
	915			920		925
Gln Pro Ile Thr Asp Leu Lys Ala Val Ser Gly Asn Gly Gln Val Asp						
	930			935		940
Leu Ser Trp Ser Ala Val Asp Arg Ala Val Ser Tyr Asn Ile Tyr Arg						
	945			950		955
Ser Thr Val Lys Gly Gly Leu Tyr Glu Lys Ile Ala Ser Asn Val Thr						
	965			970		975
Gln Ile Thr Tyr Ile Asp Thr Asp Val Thr Asn Gly Leu Lys Tyr Val						
	980			985		990
Tyr Ser Val Thr Ala Val Asp Ser Asp Gly Asn Glu Ser Ala Leu Ser						
	995			1000		1005
Asn Glu Val Glu Ala Tyr Pro Ala Phe Ser Ile Gly Trp Ala Gly Asn						
	1010			1015		1020
Met Asn Gln Val Asp Thr His Val Ile Gly Val Asn Asn Pro Val Glu						
	1025			1030		1035
Val Tyr Ala Glu Ile Trp Ala Glu Gly Leu Thr Asp Lys Pro Gly Gln						
	1045			1050		1055
Gly Glu Asn Met Ile Ala Gln Leu Gly Tyr Arg Tyr Ile Gly Asp Gly						
	1060			1065		1070
Gly Gln Asp Ala Thr Arg Asn Lys Val Glu Gly Val Glu Ile Asn Lys						
	1075			1080		1085
Asp Trp Thr Trp Val Asp Ala Arg Tyr Val Gly Asp Ser Gly Asn Asn						
	1090			1095		1100
Asp Lys Tyr Met Ala Lys Phe Val Pro Asp Met Val Gly Thr Trp Glu						
	1105			1110		1115
Tyr Ile Met Arg Phe Ser Ser Asn Gln Gly Gln Asp Trp Thr Tyr Thr						
	1125			1130		1135
Lys Gly Pro Asp Gly Lys Thr Asp Glu Ala Lys Gln Phe Ile Val Val						
	1140			1145		1150
Pro Ser Asn Asp Val Glu Pro Pro Thr Ala Leu Gly Leu Gln Gln Pro						
	1155			1160		1165

Gly Ile Glu Ser Ser Arg Val Thr Leu Asn Trp Ser Leu Ser Thr Asp  
 1170 1175 1180  
 Asn Val Ala Ile Tyr Gly Tyr Glu Ile Tyr Lys Ser Leu Ser Glu Thr  
 1185 1190 1195 1200  
 Gly Pro Phe Val Lys Ile Ala Thr Val Ala Asp Thr Val Tyr Asn Tyr  
 1205 1210 1215  
 Val Asp Thr Asp Val Val Asn Gly Lys Val Tyr Tyr Tyr Lys Val Val  
 1220 1225 1230  
 Ala Val Asp Thr Ser Phe Asn Arg Thr Ala Ser Asn Ile Val Lys Ala  
 1235 1240 1245  
 Thr Pro Asp Ile Ile Pro Ile Lys Val Ile Phe Asn Val Thr Val Pro  
 1250 1255 1260  
 Asp Tyr Thr Pro Asp Asp Gly Ala Asn Ile Ala Gly Asn Phe His Asp  
 1265 1270 1275 1280  
 Ala Phe Trp Asn Pro Ser Ala His Gln Met Thr Lys Thr Gly Pro Asn  
 1285 1290 1295  
 Thr Tyr Ser Ile Thr Leu Thr Leu Asn Glu Gly Thr Gln Leu Glu Tyr  
 1300 1305 1310  
 Lys Tyr Ala Arg Gly Ser Trp Asp Lys Val Glu Lys Gly Glu Tyr Gly  
 1315 1320 1325  
 Glu Glu Ile Ala Asn Arg Lys Ile Thr Val Val Asn Gln Gly Ser Asn  
 1330 1335 1340  
 Thr Met Val Val Asn Asp Thr Val Gln Arg Trp Arg Asp Leu Pro Ile  
 1345 1350 1355 1360  
 Tyr Ile Tyr Ser Pro Lys Asp Asn Thr Thr Val Asp Ala Asn Thr Asn  
 1365 1370 1375  
 Glu Ile Glu Ile Lys Gly Asn Thr Tyr Lys Gly Ala Lys Val Thr Ile  
 1380 1385 1390  
 Asn Asp Glu Ser Phe Val Gln Gln Glu Asn Gly Val Phe Thr Lys Val  
 1395 1400 1405  
 Val Pro Leu Glu Tyr Gly Val Asn Thr Thr Lys Ile His Val Glu Pro  
 1410 1415 1420  
 Ser Gly Asp Lys Asn Asn Glu Leu Thr Lys Asp Ile Thr Ile Thr Val  
 1425 1430 1435 1440  
 Ile Arg Glu Glu Pro Val Gln Glu Lys Glu Pro Thr Pro Thr Pro Glu  
 1445 1450 1455  
 Ser Glu Pro Ala Pro Met Pro Glu Pro Gln Pro Thr Pro Thr Pro Glu  
 1460 1465 1470  
 Pro Gln Pro Ser Ala Ile Met Ala Leu  
 1475 1480

<210> 2

<211> 2863

<212> DNA

<213> Thermoana ethanolicus

<400> 2

ttaagcttgc atcttgattc agattctgta gtaacttttt attacaacta taatacttca	60
agtgttactg attcacaaaa tatacaccaa ttccggaaga aaaacttcca agaattgtag	120
gtactataca atcagcaata ggagcaggtg atgattggaa acctgaaaca tcgacagcta	180
taatgagaga ctataagttt aacaatgttt acgaatacac tgcaaagtgt ccaaaaaggt	240
attatgagtt taaagtaact ttagggccct catgggatat aaattatggc ttaaagtgtg	300
aacaaaatgg tccaaatatt cctttgaatg tagcctatga tactaagatt acattttact	360
atgattcggg ttcacataat atatggacag attacaatcc acctctcaca gggcctgata	420
ataacatata ttatgacgat ttaaaacatg acacccatga cccattcttc cgcttcgctt	480
tcggtgcaat aaaaacaggt gatacagtga ctttgaggat acaggctaaa aatcatgacc	540
ttgagtcagc taaaatttct tattgggatg atattaaaaa aacaagaaca gaagtcccga	600

tgtataaaat	tggtcaaagt	cctgacgggc	aatatgaata	ctgggaagtg	aagttaagct	660
ttgactatcc	cacaagaatt	tggtattact	ttatacttaa	agacgggaca	aaaactgctt	720
attacggaga	taacgatgaa	caattaggtg	gagtaggtaa	agccacagat	acggtaaata	780
aagactttga	acttactgta	tacgataaaa	atthagacac	ccctgattgg	atgaaagggg	840
cagtaatgta	tcaaataattc	ccagatagat	tttacaatgg	tgacccttta	aatgaccgcc	900
taaaggaata	cagtagaggt	tttgatcctg	ttgaatatca	tgacgactgg	tatgaccttc	960
ccgacaatcc	gaatgataaa	gataaacctg	gatatacagg	ggatggtata	tggaataatg	1020
acttctttgg	tggtgattta	caaggtataa	atgataaatt	ggattatcta	aaaaaccttg	1080
gaatatcagt	tatttatctc	aatccaattt	tccaatcacc	ttccaatcac	cgatatgata	1140
caaccgatta	cacaaagata	gacgagttat	tgggagattt	agatacattt	aaaacactta	1200
tgaaagaagc	ccatgcaaga	ggaattaaag	taatacttga	tggcgtcttc	aatcatacaa	1260
gtgatgatag	tatttatttt	gatagatacg	ggaagtactt	ggataatgaa	ttaggtgctt	1320
atcaagcctg	gaaacagggg	gatcagtcaa	aatctccata	cggtgactgg	tacgaaatta	1380
agcctgacgg	tacctatgag	ggctgggtgg	gatttgacag	cttaccggta	ataaggcaga	1440
taaacggaag	tgagtacaat	gtaaaaagtt	gggcagattt	tatcataaat	aatcctaattg	1500
caatatctaa	gtattgggta	aatcctgatg	gggataaaga	tgacggtgca	gatggctgga	1560
gattggatgt	tgcaaatgaa	attgctcacg	atctctgggt	tcattttaga	gctgcaatta	1620
atactgtgaa	accaaattgcg	ccaatgattg	cagaactttg	gggagatgct	tcattagatt	1680
tacttgagga	ttcttttaac	tctgttatga	actatctttt	tagaaatgca	gttattgatt	1740
ttatactcga	taaacagttt	gatgatggaa	atgtggttca	caatcctata	gatgcagcaa	1800
aacttgacca	aaggcttatg	agcatatatg	agagatatcc	tcttccagta	ttttattcta	1860
ctatgaacct	tttaggttct	catgacacca	tgagaatatt	gacagtattt	ggatataact	1920
ctgctaatag	aaatcaaaat	tctcaagagg	cgaaagacct	tgacgttaag	aggcttaaac	1980
ttgccgcaat	attgcaaattg	ggctatccgg	gaatgccttc	tattttactat	ggtgacgagg	2040
caggacaatc	tggtggaaaa	gacccagata	acaggagaac	attctcttgg	ggaagagaag	2100
ataaagatct	gcaggatttc	tttaagaaaag	tcgtaaacaat	aaggaatgaa	aatcaagttt	2160
taaaaacagg	agaccttgaa	acactttatg	caaatggcga	tgtttatgcc	tttggaaagaa	2220
gaattataaa	tggaagaagat	gtatttggtg	attcttatcc	tgacagtgtg	gctattgttg	2280
tgattaataa	aggtgaggca	aagtcagtac	aaatagatac	tactaaattt	gtaagagatg	2340
gagttgcttt	tacagatgcc	ttaagtggta	agacatacac	ggttcgtgat	ggacaaattg	2400
ttgtagaagt	tgtggcattg	gatggggcta	tactcatttc	agatccagga	cagaatttga	2460
cggcacctca	gccaaataaca	gaccttaaaag	cagtttcagg	aaatgggtcaa	gtagaccttt	2520
cgtggagtg	agtagataga	gcagtaagtt	ataacattta	ccgctctaca	gtcaaaggag	2580
ggctatatga	aaaaatagct	tcaaattgta	cgcaaattac	ttatattgat	acagatgtta	2640
ccaatggtct	aaagtatgtg	tattctgtaa	cggctgtaga	tagtgatgga	aatgaaagtg	2700
ctttaagcaa	tgagttgagg	catatccagc	atcttctatt	ggttgggcag	gaaatatgaa	2760
ccaagttgat	acccatgtaa	taggcgtaaa	taatccagtt	gaagtttatg	ctgaaatttg	2820
ggcagaagga	ttaacagata	aacctggcca	aggggaaaat	atg		2863

&lt;210&gt; 3

&lt;211&gt; 29

&lt;212&gt; DNA

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Primer

&lt;400&gt; 3

ggggaattcg atctcgattt ttgaggaat

29

&lt;210&gt; 4

&lt;211&gt; 29

&lt;212&gt; DNA

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Primer

<400> 4  
 gggggatccc atagctatatt gtacttgct 29  
  
 <210> 5  
 <211> 29  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Primer  
  
 <400> 5  
 gggggatccg ggattaaata gctgggcca 29  
  
 <210> 6  
 <211> 26  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Primer  
  
 <400> 6  
 cgggattcct taagcttgca tcttga 26  
  
 <210> 7  
 <211> 33  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Primer  
  
 <400> 7  
 ccggcgccg cctacatatt ttccccttgg cca 33  
  
 <210> 8  
 <211> 27  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Primer  
  
 <400> 8  
 tccgagctcc agatcggtca aacattt 27  
  
 <210> 9  
 <211> 26  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Primer  
  
 <400> 9

agcgagctcg atcgatctag taacat

26

<210> 10  
<211> 27  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Primer

<400> 10  
cgccgcggta gctttagcta tagcgat

27

<210> 11  
<211> 27  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Primer

<400> 11  
tccccgcggg tcctctaagt gaaccgt

27

<210> 12  
<211> 28  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Primer

<400> 12  
cgcatatggt aagcttgcatttgattc

28

<210> 13  
<211> 31  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Primer

<400> 13  
ccgctcgagc tacatatattt ccccttgccc a

31